RAILWAY ENGINEERING

AND MAINTENANCE OF WAY

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Railway Engineering
and Maintenance of Way

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OPPORTUNITY

¶ You remember what Dooley has to say about "Opporchunity"—if you don't you had better hunt it up. You can buy his works at any book store and that will encourage the book business. It's worth reading just at this time when we are on the eve of the greatest activity in business that this country has ever seen.

¶ We are optimistic? Well we have a reason for our optimism. We know where real business is being done, big orders being placed; not inquiries, orders. And speaking of inquiries, there seem to be plenty of them and good ones. Of course we can only judge from our own view point and from what we hear from our own little circle of friends.

¶ But as we write this for our October number we have before us a letter which reads as follows:—"We are pleased to report the receipt of a very satisfactory volume of business which seems to be keeping up nicely. We give you below a list of only the most important contracts and orders received from September first to date." Then follows a list of orders and it takes nearly three typewritten pages to give the various contracts.

¶ Opportunity? Most assuredly there is plenty of opportunity to do business and do it now. Only last week a big car order was let by one of the large railway systems. It is hardly to be expected that we are to have an opportunity to do the business that was being done a year and a half ago or that we are to leap into ultra prosperous business conditions with a single jump. But things generally are getting better all along the line and now, we don't like to talk shop out of working hours, but really, now is the time to advertise. It's your opportunity.

CLASSIFIED INDEX OF ADVERTISERS

Anti Rail Creeper.
Adreon & Co., St. Louis.

Asbestos Products. All kinds.
Franklin Mfg. Co., Franklin, Pa.

Asbestos Roofing Slates.
Franklin Mfg. Co., Franklin, Pa.

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Adreon & Co., St. Louis.

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Cars Dump.
Rodgers Ballast Car Co., Chicago.

Cars Rebuilt.
Atlantic Equipment Co., New York.
Hicks Car & Locomotive Works, Chicago.

Car Replacers.
Buda Foundry & Mfg. Co., Chicago.

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Atlantic Equipment Co., New York.

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Reinforced Concrete Pipe Co., Jackson, Mich.

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Railway Supply Co., St. Louis.
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Atlantic Equipment Co., New York.

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Electric Crossing Bells.
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Forgings .
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Porter, H. K., Co., Pittsburg.

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Porter, H. K., Co., Pittsburg.

Locomotives, Rebuilt.
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Hicks Locomotive & Car Works, Chicago.

Locomotives, Second Hand.
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Hicks Locomotive & Car Works, Chicago.

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Henderer's, A. L., Sons, Wilmington, Del.

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Indianapolis Switch & Frog Co., Springfield, O.
Hicks Locomotive & Car Works, Chicago.
McCord & Co., Chicago.

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CONTENTS

Illinois Central Terminal Electrification

THE electrification of the Chicago terminal of the Illinois Central Railroad was recently considered by the directors of the company and authority was given for a full investigation of the problem. This may be looked upon as the first step toward the ultimate electrifying of the terminal, because it is well known that such a change would result in a reduction in operating expenses, particularly with the suburban lines.

While the operation of through passenger and freight trains by electric locomotives is not by any means an easy problem, it is not beyond solution. It may be possible to electrify the suburban lines previous to the through passenger and freight traffic, because they are separate from the through lines and the trains could be operated by electric motors on the trucks. The investigation will no doubt be favorable to the electrification of the Chicago terminal, but there are many considerations which may call for necessary delays.

School of Railway Engineering and Administration

IN the September issue mention was made of appointments to the engineering staff of the University of Illinois, several of which concerned the School of Railway Engineering and Administration. The strength and efficiency of the school has been increased materially since its establishment two years ago by the University.

The Dean of the College of Engineering is director of the school. There is an associate professor of railway engineering in general charge who is especially concerned with railway equipment problems. An assistant professor of civil engineering gives his attention to track construction and maintenance and to signaling. Problems in locomotive performance and train resistance are handled by an instructor in railway mechanical engineering. Specialified problems of electric traction are in charge of an associate in railway engineering. The organization of the school within the Department of Economics consists of a professor of railway administration and an instructor in railway accounting.

The engineers, who were appointed, are men with wide experience in railroad work who have had the necessary experience in their respective departments. It is this fact that should be noted in considering the progress and growth of the railway school.

Concerning Timber Supply

THE question of our timber supply has been discussed seriously for the past few years because of the decreasing supply and the increasing demand in our many industries. Both means for maintenance of supply, such as forest preservation, and the more economical use of the present supply, have been brought into consideration.

Relative to the advance which forestry has made in the past ten years, the following quotation from the

Year Book of the Department of Agriculture for 1907 is given:

"Forest lands under management have grown from one to two tracts to many, aggregating 7,503,000 acres, scattered through 39 states. The national forests have increased from 39,000,000 acres, practically unused and unprotected, to 165,000,000 acres, used, guarded and improved both in productiveness and accessibility. The number of states which have state forests has increased from 1 to 10; and of those which employ trained foresters from none to 11."

While there has been an awakening to the necessity of preserving our forests and certain progress, as noted above, has been made in the growth of timber, the supply is now several times less than the demand. A beginning has been made in forest preservation and it is to be expected that this country with its natural resources will in future years be foremost in the growth of timber. Even at this time it is said that the United States furnishes about 20 per cent of the lumber imported by other countries.

In order to secure the most economical use of our present supply, certain woods are now treated with preservatives which prolong their life many times. The use of preservatives was resorted to in European countries before a thought was given to the matter in the United States, yet it is said that now the treating plants in this country excel both in size and mechanical perfection.

Railroads are chiefly concerned in wood preservation because it has become almost a necessity to use soft woods for ties and without treatment these soft wood ties have a very short life. The treated tie has proved satisfactory, its life being increased so as to compete favorably with the hard wood tie. In a circular of the Forest Service by W. F. Sherfesee, the following statement is made:

"The saving due to treating railroad ties is also worthy of consideration. A loblolly pine tie untreated is worth about 30 cents and its length of life in this condition is about five years. To this first cost should be added the cost of laying, which is about 20 cents. The annual charge figured at 5 per cent. compounded is then 11.52 cents. If treated it will last for about twelve years. Its cost of treatment is about 35 cents. A treated tie in the track, therefore, costs about 85 cents. Compounded at 5 per cent. its annual charge is 9.48 cents. The saving per year is therefore 2.04 cents per tie. Assuming 2,880 ties per mile of track, the saving due to treatment alone amounts to $58.75 per mile, which corresponds to an investment of $1,175 per mile."

In connection with the use of treated soft wood ties, attention is being given to the use of screw spikes and tie plates. The tie plate and screw spike should follow naturally as they also prolong the life of ties and especially soft wood treated ties. In the May, 1908, issue of this journal an outline of the advantages resulting from the use of screw spikes was given, together with reasons for their more extended use.

It is evident that both timber preservation and the treatment of wood are now vital commercial problems which shall require the closest attention in view of the foreseen exhaustible supply.

Single Phase Motors

IN considering installations of alternating current motors, it is frequently the case that little or no attention is given to the single phase motor. This alternating current motor is not as well known as the polyphase even though efficient and reliable motors of this type have been in use for many years. The single phase motor has been looked upon as a complicated machine involving too many auxiliary appliances to be of practical value. While this motor is not as simple in construction as the polyphase induction motor, it is by no means true that it will not meet requirements in service.

The single phase motor is not difficult to operate. It requires only the closing of a switch as does the polyphase. The cost of maintenance is small and its life is in most cases insured until disintegration of the coils occurs or until the bearings are worn out.

The load which the motor will carry under normal speed is the load which the motor will start under. It has a high starting torque equal to that of the polyphase motor.

Variable speed single phase motors are also built. In fact there are many places where the single phase alternating current motor can be used to advantage. Where only single phase alternating current and direct current are available, it is not necessary to adopt the direct current motor as the only means of obtaining electric power.

Remodling an Old Shop

IN remodeling an old shop, complications that do not enter into consideration when building an entirely new shop plant, are frequently encountered. The size and limitations of the property on which the original shop stands, impose the greatest impediment, especially so in case the land occupied by the shop is entirely or nearly covered by shop buildings.

Under such conditions it is impractical to suspend entirely the operation of the original shop. Yet when the work of remodeling and rebuilding has been begun, it is the desire of all concerned to bring the construction work to completion as soon as possible. Naturally, more or less delay results from the impediment imposed by the old buildings and the fact that a clean sweep can not be made to clear the path for new work. Therefore the determination of a practical method whereby an old shop may be replaced by a new one, without materially interfering with its operation, is a difficult problem. Its solution requires familiarity with the routine of the shop operation and clever engineering ability to remove and replace equipment so that no department is unnecessarily hampered.

The work of improving and extending the West Springfield shop of the Boston & Albany Railroad presented just such a situation. On the site of the original shop plant new buildings were erected to house the erecting, boiler and tank shops, power house and storehouse and office building. The structural steel for this work was received late in October, 1907, and by the first of January, 1908, locomotives were being turned out of the new shop. During the remodeling and improvement period the shop continued its output of about eighteen engines per month. This shop was remodeled and rebuilt by Westinghouse, Church, Kerr & Co.

An Interior Track for Storing Mounted Wheels

THE passage of mounted wheels in and out of a shop building causes much discomfort in cold weather because of the frequent opening of large doors. This discomfort is felt particularly by machine operators and others working near the doors, though the entire shop is chilled more or less and all occupants feel the effects of drafts to some extent.

The comfort of workmen is being realized more and more fully in its effect upon output and where it is not looked upon from a humane standpoint, it is worthy of consideration as a business proposition. For this reason the provision of a storage track of sufficient length to hold a large number of wheels seems well worthy of consideration in preparing plans for the arrangement of a car wheel or car machine shop. By the use of such a track the output of the machines may be temporarily stored within the building until the track has been filled. This will permit the doors being opened at infrequent intervals and will provide against an almost continuous opening.

One railway, for instance, has constructed a car wheel shop as an extension of the building containing the coach repair shop, and tributary to the freight car erecting shop. The car wheel shop has been made of such length as to allow space for a track traversing the entire width of one end of the building. This track is tributary to the wheel presses and during cold weather the doors serving this track are kept closed except when the track has been filled. The wheels are then run out as rapidly as possible, after which the doors are closed promptly.

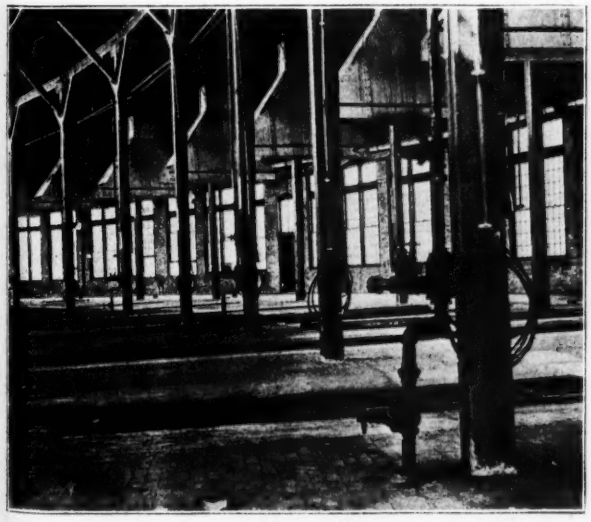
Scrap wheels are run out of a small door adjacent to the wheel press, causing no inconvenience in any way.

Kirk Yard, Gary, Indiana

C., L. S. & E. Ry.

THE terminal shops of the Chicago, Lake Shore & Eastern Railway at Gary, Ind., were described in the September issue, which also contained plans for the layout and important structures. The accompanying photographs are published to show more clearly the construction adopted and the present status of the work.

The interior view of the roundhouse shows the arrangement of facilities and several important features. The brick floor with concrete pits and method of supporting the rail will be noted. Steel slips placed at intervals secure the rails directly to the concrete walls of the pit. The air, steam and water pipes are also shown.



INTERIOR OF ROUNDHOUSE, C., L. S. & E. RY.

The smoke jacks are constructed with Transite asbestos plates, angles, etc., after designs furnished by the engineering department of the railroad. This material was used with the idea of preventing corrosion common to smoke jacks. The roundhouse is well lighted, the available outer wall area being fully utilized and swing sashes being used between the two sloping sections of the roof and also above the doors in the inner wall.

The car repair shop is shown in the course of erection. This shop, which covers an area of 95 ft. 10 ins. by 240 ft., will be devoted to the repair of steel car equipment. The construction of the roof with monitor windows, together with the windows in the side and end walls, affords an abundance of natural light. Besides, a concrete roofing tile with inserted panes of glass was

CAR REPAIR SHOP, C., L. S. & E. RY.

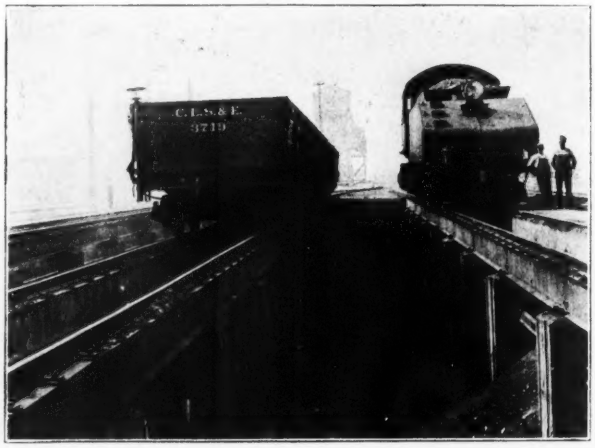
COAL CHUTE AND WATER TANK, C., L. S. & E. RY.

used for a section of the roof to give additional light. If the latter construction is a success, as far as freedom from breakage of glass and tile and freedom from leakage is concerned, it will be highly approved because its lighting advantages are recognized.

The coal chute, which is of frame construction, has a coal capacity of 100 tons, not including the 20 pockets. In the view the 100,000 gallon steel water tank is shown at the right. The cars are pulled up the 20 per cent incline by a cable and hoist operated by an electric motor and the coal is dumped into the large bin from which it falls into the Williams & White pockets by gravity. The tracks on either side lead directly to the roundhouse turntable and pass over the cinder pit.

The construction of the cinder pit and the arrangement of tracks is clearly shown in the accompanying photograph. The gantry crane, which travels the full length of the pit, is not shown in the view, but it will be noted how easily cars on the center track can be loaded with the clam shell buckets. Only one man is required for loading the cinder cars. An engine is shown on one of the two outer tracks, where the ash pans are dumped. The method of supporting and fastening the rails on the concrete piers is plainly shown. The side walls are sloped so as to throw the cinders toward the center of the pit.

The sand tower was constructed as shown to span one track on account of the limited space as well as a matter of convenience. Locomotives receive sand from either of the tracks on the side, these tracks leading to the roundhouse turntable. The sand is lifted into the 7 x 7½ x 20-ft. bin by air pressure.



CINDER PIT, C., L. S. & E. RY.

The general arrangement of these shops and the designs of the various structures point to economy in operation. Details of construction have not been overlooked and many improved features are therefore evident.

Rules for Care of Lamps.

THE revised rules of the Atchison, Topeka & Santa Fe Railway, covering the care of signal, switch and other lamps, are as follows:

1—Standard headlight oil as furnished by the company must be used in all signal lamps, except hand lanterns. Signal oil is furnished for lanterns only. No attempt must be made to improve the quality of signal oil by adding lard or kerosene oil. Signal oil is rendered explosive if the lard and kerosene oils are mixed in the wrong proportions. If the oil does not give satisfaction, the trouble must be reported to the lamp inspector.

2—All lamp fonts must be emptied and drained once a month and refilled with fresh oil. At points where a number of lamps are used, the old oil thus removed must be poured into a can kept for that purpose and marked "Old oil only." When filled this can must be sent to the nearest roundhouse or company yard, and the oil used for such purposes as cleaning trucks, etc., but on no account must it be used for lamps again.

3—All vents in lamp bodies must be kept open and clear of soot and dirt, so that lamps will receive the proper amount of draught. The tops of lamps where soot is likely to collect must be kept clean.

4—Special attention must be given to the lenses, to keep them clean. Occasionally a strong solution of lye and water should be used, which will cut off any kind of dirt.

5—If the burners become fouled with oil, soot or incrustations from the wicks, they can be cleaned thoroughly by dipping in boiling water. The gas vent in the burner must never be allowed to become closed.

6—The sulphur must be burned off the match before it is applied to the wick, to avoid incrusting the wick with sulphur.

7—In the tops of all standard lamps (standard lamps have a number plate with the letter "S" before number —as S5020), there is a draught flue which must be taken out once a month and cleaned. To remove it give a slight turn to the left.

8—Lamps that have cracked lenses need not be sent in for repairs, except they leak air and cause the lamp to blow out. Lamps that have chipped red lenses must be changed.

9—In no case will employes be allowed to make alterations in lamps. If they do not give satisfactory service the trouble must be reported.

10—When a lamp from any cause becomes unserviceable, a requisition must be made for a lamp to replace it, and as soon as the latter is received, the defective lamp must be sent in to the general storekeeper.

SAND TOWER. C., L. S. & E. RY.

11—Agents and others whose duties necessitate their using red, white and yellow lanterns, will keep them trimmed and ready for immediate use, either on the lamp closet or hanging over it.

12—When taking down or replacing lamps used on semaphores, the glasses in the semaphore arm spectacle must be inspected, and if dirty must be cleaned. If the glass is cracked or broken, the fact must be reported by telegraph to the trainmaster and signal engineer.

13—Tops must be kept on oil cans to keep out dust and dirt.

DIRECTIONS FOR THE CARE OF LAMPS USING ANY BURNER, OTHER THAN THE LONG-TIME BURNER.

14—A space of ¾ in. must be left unfilled in top of lamp fonts to allow oil to expand when it gets hot.

15—The wick must be long enough to touch the bottom of the font, and must fit in the burner properly. Wicks that will not move freely by turning the ratchet shaft are apt to clog the burner, prevent a free flow of oil to the flame, cause the burner to overheat, incrust the wick, give a smoky flame, and sometimes cause an explosion.

16—When the ratchet wheels will not properly raise or lower the wick, the wick should be drawn up through the wick tube with the fingers and then moved back to place by the ratchet wheel. If a wick is too large for the wick tube, it can be reduced by drawing out a few threads.

17—The wick must be kept below the top of the wick tube in the burner when the lamp is not lighted to prevent oil flowing from the wick over outside of the font and the burner.

18—Lamps must be cleaned, fonts filled, wicks trimmed and burners cleaned daily.

19—To light lamps properly: After lighting the wick turn it down low and put it with the font inside the body of the lamp. In five minutes take it out and turn the flame up to full height—1 in. above top of burner. To get proper light to prevent No. 1 signal burner from smoking, the flame must be one inch above top of burner. The jaws of the burner should be ¼ in. apart. If they expand from heat, press them together again—otherwise the burner will smoke.

DIRECTIONS FOR THE CARE OF LAMPS USING THE LONG-TIME BURNER.

20—Lamps using these burners should be trimmed twice a week, but will burn 84 hours if needed.

21—Remove the burner from the oil cup and cut the wick square, 1-16 in. above top of burner.

22—When lighted the flame should be about ¾ in. high. If the wick is trimmed too high it will smoke within 20 minutes.

23—After the first lighting the wick will probably not require cutting oftener than once a month, but the crust should be carefully brushed from the end of the wick with the finger when re-trimming the lamp, and if the wick becomes pointed or irregular on the end, it should be cut square.

24—Change wicks every two months—oftener if dirty.

25—When the wick is brushed or cut, it should be raised 1-16 in. above the top of the burner before lighting.

26—Leave a space of ¾ in. in the oil cup unfilled, to allow the oil to expand when hot.

27—To ascertain if the lamp is burning in day time, look through the lens. Avoid opening the lamp, as the wind may extinguish the light.

28—Clean out the oil cup every month.

29—Lamps must fit freely on switch forks, otherwise the flame may jar out.

Is Spike Raised from Tie by the Wave Motion of Rail Under Traffic?

Editor, RAILWAY ENGINEERING:

I have been a reader of RAILWAY ENGINEERING and other railway literature for several years and while I have read a great many discussions on different methods of work and the cause of quite a number of evils existing in railway maintenance, I never have as yet heard any one take up the question of the so-called raised spike, which a great many engineers, road masters and section foremen claim is due to the wave motion of rails under traffic. I have been a close observer of this feature and I believe that while I may not treat the matter in as many words as some may be able to do, I think I can lay the foundation for some one to either approve or disapprove of what I have to say.

At the outset, allow me to admit that I believe that under extreme wave motion, such as will be more often found on mud track where joints and soft places are often found swinging from one to two inches, the spike will draw loose to a certain extent. In the northern states where the roadbed freezes solid during the winter months and frost shiming is resorted to in maintaining a better surface, it will be found that in the process of this frost shiming the original bonds with spikes and ties are broken. After the shims have been removed, the spikes tapped down and the place tamped up, if the same

place should become low again, the spikes would raise in the ties. This is due to the fact that, as before stated, the original and best holds are broken between the spikes and the ties.

The question, however, I wish to bring out is the effect that wave motion under favorable conditions has in causing the spikes to lift from the ties. I am now employed by a railroad that on account of certain conditions uses a great many chestnut and inferior oak ties, and I have been a close observer of the action of heavy traffic over such ties and have found that, in every case where the spikes were found standing up from the rails, measurements would show that, instead of the spike working up, the rails had worked down into the ties, the distance from the under side of the spike head being approximately the same as from the rail seat in the tie to the top of the ties. This fact shows that instead of the spike raising up, the rails had worked down.

Again, I have found that where new ties have been put in and tamped so as to have a solid bearing, that within from six to eight months the spike would stand up from the rails from 1/8 to 3-16 of an inch, depending, of course, on whether it be a tough, brash, soft or sawed stick. After going over the second time and tapping the spike down firmly to the rails, I would have no more trouble of this kind until the ties had become soft and the rails had worked down farther into the ties.

Taking the above into consideration, I feel at liberty to state that I do not believe that spikes are raised from reasonably good ties under favorable conditions due to wave motion.

Yours truly,

E. L. Flinn.

Roadmaster, C., G. & P. R. R.

New Passenger Terminal Chicago & Northwestern Railway

THE Chicago & North-Western Ry. has announced that the architectural plans for the new Madison street passenger terminal are completed and the drawings about ready for exhibition to the public. These drawings indicate that the new terminal will be one of the finest architectural features of Chicago—a splendid structure of classic design, the essential feature of which is a great colonnaded entrance or portico of lofty proportions, monumental in type, that towers to a height of 120 ft. above Madison street. Before this imposing front is a broad pavement or esplanade from which will rise the granite columns that guard the inner vestibule. The esplanade will be lighted by monumental bronze lamp standards, from which clusters of electric lights will blaze at night; and four big clock dials, each 12 ft. in diameter, will look down from the granite walls.

There are six other public entrances to the building, and the stairways are so ample that if placed side by side they would form steps 100 feet broad. Growing traffic requirements have made this big $20 000,000 improvement an early necessity. The present Wells street station, with capacity for handling 50,000 passengers per day, will soon be overtaxed, and the new terminal, with facilities for taking care of a quarter of a million people every 24 hours, needed to take its place. For many years President Hughitt has been weighing the needs of the case, and with broad forethought, has planned to give the traveling public a fitting place for arrival and departure, and at the same time to provide Chicago one of the finest architectural monuments of which the city can boast—a beautiful building, designed along classic lines, and built under instructions to make the very best building in every particular that modern architectural enterprise can build.

Many months have been spent in negotiations for the necessary real estate for the big station and its approaches; and it is typical of North-Western policy that these purchases and transfers have been made in a spirit of liberal settlement with property owners, to which is due much of the credit for the remarkable progress that has marked the course of the negotiations. The site is now being rapidly cleared, and the workmen will soon begin to sink the great caissons on which the building is to rest, reaching 106 feet down to bed rock. The North-Western officials believe they will have the new terminal ready for occupancy by January, 1910.

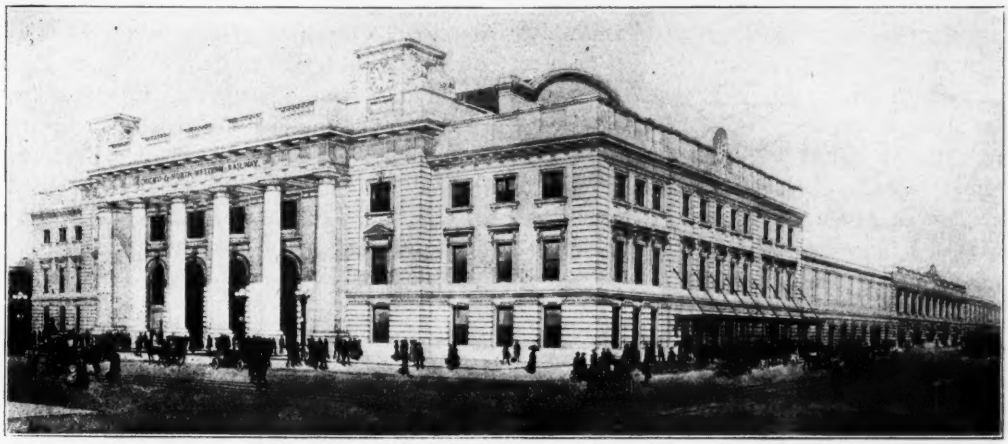
The plans call for an elevated terminal, reached by two elevated approaches of four tracks each, and a train shed 840 ft. long and 320 ft. wide that will contain 16 tracks, each with a capacity of 15 cars. The approaches alone to this structure embrace some 30 acres of ground, 15 acres for the north and an equal amount for the west approach. This is entirely separate, and in addition to the present main lines.

Between Kinzie street and Madison street and Clinton and Canal streets some 13 acres will be occupied by the tracks and station. It is difficult to comprehend the magnitude of the building; for instance, the area of the basement is over two acres; the street floor of the station building is 1¾ acres; the train shed six acres. There will be practically ten acres of floor space devoted to public use.

The new terminal will occupy practically four entire city blocks, bounded by Madison street on the south, Kinzie street on the north, Clinton street on the west and Canal street on the east, passing over Washington and Randolph streets by means of brilliantly lighted subways.

For a clear understanding of the architecture of the new terminal it must be borne in mind that there are, first, the street level; second, the train shed level, or main floor; and above this, a third floor, containing several features such as rest rooms and emergency rooms for the care of invalids.

On the street level, the essential feature of the whole floor is the great lobby, or concourse, where all the business of preparing for travel is conducted. The lofty vestibule or portico which forms the Madison street entrance, opens directly into this public concourse, which has an area of 100 by 250 ft. Surrounding it are ticket



NEW PASSENGER TERMINAL STATION AT CHICAGO, CHICAGO & NORTHWESTERN RAILWAY.

offices, cab offices, news stands, baggage checking rooms, telegraph office, telephone booths, an automobile office, taxicab office, and a well-stocked shop or store in which may be purchased practically everything that a traveler is likely to be in need of, from a handbag or package of shoe polish to the usual fruits, candies and materials for luncheons. The management proposes to develop this store into a feature the like of which has never been seen in Chicago, and it will be completely stocked with all travel conveniences. There will be a lunch room on this floor—quite a large one—occupying a room 50 by 90 ft., where luncheon can be had quickly, conveniently and at reasonable prices.

The ticket offices immediately adjoin the entrance to this great lobby on the street level floor. They will be commodious and fitted with a number of features that will enable ticket sellers to handle large crowds of people in the shortest possible space of time. There will be plenty of windows and a carefully chosen corps of experienced attendants. The information bureau, which is a notable feature of the North-Western's passenger service, will be upstairs upon the train level floor, in the great waiting room. Ample means of communication by wire is provided in elaborately equipped telegraph offices, where telegrams and ocean cable messages may be filed, and telephone booths are placed in various parts of the building convenient for the use of both city and long distance wires.

A splendid suburban concourse is provided in the center of the station on the street level floor, extending through from Canal to Clinton streets, through which suburban passengers inbound and outbound can conveniently reach the northern part of the town via Randolph or Washington streets. Those whose destination is further south can use the Madison street entrance.

The cab stands and automobile stands adjoin the suburban concourse, which is also provided with ticket offices and other conveniences. These cab stands and automobile stands are under cover. In fact, everybody can arrive and leave the terminal under cover, either by cab, automobile or street car.

Another part of the great space that is to be utilized is devoted to the care of immigrants. Here, in a clean and well-lighted apartment with tiled floors and enameled tile walls, is a waiting room which, with its accessories, surpasses anything that has heretofore been provided for that class of travel. There are bath rooms, toilet rooms and a dining room where for a small sum the immigrant can get excellent service, lunch room, kitchen, laundry tubs, and every conceivable means of adding to the comfort and cleanliness of the immigrant who is so fortunate as to hold a ticket reading over the North-Western line.

President Hughitt has insisted that all subways and all apartments in the lower story of the station shall be bright, clean and cheerful, and the architect has given all of these lower parts of the building a treatment of cream-colored enameled tile and a brilliant lighting equipment.

The structure crosses Washington street over a subway which of itself is a work of architectural perfection. The white enameled tile with which the subway is lined, and the brilliant arrangements made for its electric lighting, make it one of the most attractive features of the structure. This subway at Washington street has been provided with great portals of granite, the arches of which are treated in the monumental style of architecture. The street will be widened at this point to 120 ft. instead of the street width of 80 ft. This provides for the future widening of the street, and the arched walls of the subway will form as fine a passageway as one would find in a fine hotel or beautiful home.

On the second floor, which is the train shed level, is a splendid marble lined waiting room, 100 ft. long, 200 ft. wide and 80 ft. high with a vast barrel-vaulted ceiling. The walls are treated with a series of columns or colonnades corresponding somewhat with the main entrance. The lighting arrangements of this room will be of a most brilliant character. On this floor there will be, in addition to the great waiting room, one of the finest dining rooms in the country, a splendid room, around the walls of which will be a series of panels that

can be utilized for magnificent mural decorations portraying the history of the west and northwest with which the development of the North-Western line has been so intimately connected for the past sixty years. It is proposed to make the service in this dining room equal to that of the best metropolitan hotels and clubs.

On this main floor is also a ladies' waiting room, a beautiful apartment, reached by separate elevator service. Connected with it are retiring rooms, baths and toilet arrangements all of which will be in charge of a corps of maids and attendants.

Perhaps some of the most novel features of the entire plan for the new terminal, and of most interest to the traveling public, are those which are found on the third floor of the building. Here away from the noises of the street and the crowds, the architects have planned, with much skill and forethought a series of rooms where invalids or ladies with children or infants, or others seeking privacy, may go directly by private elevator to rooms where they may rest while waiting for connecting trains, surrounded with conveniences for which one must usually go to a hotel or to one's own home. Here are baths, tea rooms, retiring rooms, and emergency rooms where hospital service is rendered and nurses are in attendance. A competent matron is in charge.

On the other side of the building on this same floor are baths, barber shops and a lounging room for men. This suite is also reached by separate elevator service, and here are private rooms where the suburban dweller or the traveler from a distance may remove the stains of travel, change to evening clothes and proceed to his various social appointments. It is anticipated that this will be greatly appreciated by the large suburban clientele of the road.

The terminal will be provided with its own lighting, heating and ventilating plant, in which modern and complete machinery will be installed. Toilet facilities have received, like the various other conveniences, a great deal of serious thought, and not only are the usual public toilet rooms being provided for on a most expensive scale, but special rooms are also planned, where uniformed servants are always in attendance and where a small fee is required. In fact the toilet facilities of all the terminals in the United States have been looked over in detail, and their capacity multiplied upon. There will be men's attendants, women's maids, men's baths, women's baths, and every imaginable feature that will add to the comfort of North-Western patrons.

The entire structure is absolutely fireproof. All floors will be of marble or of marble tile, the interior finish of waiting rooms and lobbies will be of marble and the exterior of the building will be of a light gray granite.

One of the most important features, from an architect's point of view, is the treatment of the train shed. This structure will be 840 ft. long, extending over three city squares, but it will not have the usual long, black expanse of sooty roof that offends the eye. On the contrary, the facade running north and south along Canal street and Clinton street will be a finished and artistic curtain wall of brick and granite, 48 ft. high, and including in its length the fine portal of the Washington street subway. The train shed roof will not be visible. The sixteen long tracks which will occupy the shed will be covered by what is known as the "Bush roof," in which the graceful curve of the roof over each pair of tracks is broken by a concrete slot or duct, running the length of each track and so placed that the locomotive funnels will discharge through it into the open air. The roofs will be of concrete, covered with water proofing material. Skylights will be of wire glass and sufficient in extent to light every part of the train shed. In this, as in track elevation and various other transportation improvements, the North-Western has taken the lead and acted in its well-known capacity as the pioneer line. Nothing of the kind has ever before been tried in Chicago, and it is said to be a marked improvement in the construction of railway terminals.

The train shed concourse has also received in the architect's plans a treatment that is far superior to that usually seen. Instead of being an open space, fenced off from the train shed proper by wire or open ironwork, it is, as a matter of fact, simply a great waiting room, completely enclosed in glass and metal, with a glass and metal roof, making an airy, bright, clean room, 318 by 60 ft. At either end of the concourse great stairways communicate directly with the street, and cab stands are reached without going through the station. There is also a stairway to the street floor of the station proper. These broad stairways between the street level and the train shed level of the terminal are of such extent that placed side by side they would form a stair over 100 ft. broad.

Regarding the exterior of the new terminal too much cannot be said in commendation. Messrs. Frost and Granger, the architects of the LaSalle street station, have had charge of the design and have visited and studied the world's principal railway terminals at London, Liverpool, Paris, Vienna and Edinburg, in search for suggestions that would help to make this new station at Chicago the best that money would build, not only as to general architectural effect, but particularly with a view to making it most nearly perfect for the practical use to which it is to be devoted, viz., a portal or entrance through which the patrons of the North-Western may most expeditiously and comfortably transact the business of entering or leaving the city of Chicago. And in this connection it should be borne in mind that the entire structure is devoted to this one business. It is not an office building nor a railroad headquarters; but is, on the contrary, to be devoted wholly to the uses of the public.

It will, with one exception, be the largest railway terminal in the United States. More than three hundred trains a day now use the Wells street station for arriva

and departure, and in order that the natural increase in this number may be provided for, the train capacity of the new terminal will be five or six times that of the present station.

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*Snow Melting at Switches**

DURING the winter months the snow and sleet storms and the freezing temperature, causing the water from leaky locomotive tanks, overflow from injector pipes on engines, drips from car heating piping and water from train lavatories and kitchens, emptied into the switch and interlocking mechanism in the railroad yards, to freeze, render the switches inoperative. This "water trouble" is one of the constant causes for delayed traffic during the winter months. During severe blizzards delays are such, at times, as to completely cripple the train service due to the ineffective efforts of the railroad employes, supplemented by the inefficient green snow help, to "hand-clean" the switches. During such storms, with the detector bars frozen to the rail; the snow turned to ice by dripping water from various sources and pounded into the heels of the switches, and snow and ice working in around nuts on adjusting rods, having the same effect on switches as too tight adjustment and thereby preventing the tower operator from getting locks in place until the mechanism is free, comes the question, "Is there no practicable relief from our difficulties?"

In answer to the problem various schemes have been projected whereby it was proposed to free the track and interlocking mechanism of snow and ice, but they all have the great disadvantage of necessitating an extensive and costly installation under and around the rails and switch mechanism. This fact alone has rendered them impracticable, even if it were not necessary to remove such installations whenever it became necessary to tamp the ties or make other track repairs, and also the fact of the short life of metal fittings in railroad yards, due to the action of the acid from the sparks and cinders. Such installations are also liable to derangement, or even to be put entirely out of commission, at the critical time of a blizzard, in case of a derailment, which is more likely to occur at the time of a storm than at any other.

During the past year attention has been attracted by a new system of snow melting used on some of the large terminals, and during the past three winters at one of the busiest terminals in the country, with the result that delays due to snow and sleet storms have been almost entirely eliminated. The melting of the snow or ice is effected by applying to it a flaming fluid of special character, which continues to burn while in the snow, melting and finally evaporating the greater portion of it. On account of the special character of the fluid the flame is easily maintained regardless of the high winds of the storm or the drifting of the snow.

The fluid, which is a hydro-carbon, is applied by the regular track force by means of a safety distributing can, and the height and extent of the flame can be regulated with ease. No injury to the track results from the use of this combustible, as the temperature of the rails is not raised to the usual summer heat.

One of the first steps in installing this system is necessarily the installation of sufficient storage capacity for the fluid. This would vary in proportion to the number of switches which it was desired to keep operative, the average severity of the storms and the facilities for obtaining the fluid. The fluid is obtainable in the open market at from 3 to 5 cents per gallon, and may be obtained free of cost by railroads operating their own Pintsch gas plant.

At one plant where this system has been in use the tank, having a capacity of several thousand gallons, was connected with the compressed air used by the interlocking system, and when about 10 lbs. air pressure was admitted to the tank, the liquid was forced through buried piping to the several drawing outlets, located in various parts of the yard.

The storage arrangements may therefore vary from only a single 200-gal. iron drum, elevated upon blocking where only a few switches are to be looked after, to a tank of several thousand gallons capacity, feeding various lines of underground piping, in yards where the number of switches is large, the territory extensive, or where it is inconvenient or dangerous to cross tracks or where there is no convenient near-by location for a tank.

The supply stations for the distribution of the fluid are provided with safety self-closing faucets, and drawing gauges which enable the operator to readily tell when the cans are being filled how much fluid they contain and how much is being used. The storage for the fluid may be by means of a single large tank connected by underground piping to various drawing outlets suitably located with reference to the territory to be protected. It may also be stored and distributed from small iron drums or barrels located upon blocking in various parts of the yard to be served. The latter method of distribution is cheaper in first cost, though not as sightly or as convenient as the former.

It may be of interest to give a comparison between this method of switch cleaning and the ordinary method of hand cleaning, and below is given data derived from a storm occurring during the past winter at one of the busiest of the railway yards. In comparison with the results obtained by the hydro-carbon system is given a careful estimate of corresponding cost of hand cleaning, based upon the experience of previous years, and corresponding snowfall.

HAND CLEANING OF YARD SWITCHES.

150 extra men, 24 hours each, 3,600 hours, at 20 cts. ..... $ 720.00

*From a paper by James S. Lang, read before the Railway Signal Association at Chicago, Sept. 8, 1908.

33 regular men (including foreman), 30 hours each	181.70
Meals: 150 men, 3 meals each, 450 meals; 33 regular men, 3 meals each, 99 meals; or a total of 549 meals, at 20 cts.	109.80
	$1,011.50

USING THE SNOW MELTING SYSTEM.

No meals (men enabled to leave for meals.)	
No extra men.	
Regular men, 20 hours each (duration of storm 24 hours, absent 4 hours for meals)	$ 121.80
Hydro-carbon, 1,900 gallons at 4 cts.	76.00
Incidental charges, and rentals, which might regularly be charged to storm in question.	66.60
	$ 264.40
Saving effected in one storm	$ 747.10

The severe storm above was taken care of without a single delay chargeable to snow, and switch failures were less than 1 per cent. of the usual number.

Losses by Marine Borers on Pacific Coast

Marine wood borers, which attack piling and other timbers placed in salt water, are causing the engineers in charge of the construction of marine works on the Pacific coast much concern. They are particularly destructive along the coast from southern California to Alaska, and shippers are beginning to realize that a cheap preservative treatment for this class of material would secure a big saving. On the average an untreated pile lasts in these waters not more than three years.

A great deal of time and money has been spent by individuals and corporations in the effort to prolong the life of these timbers. Different styles of pile casings, made of copper, zinc, cement and other materials, have been constructed and patented, and at the present time piles thus encased are under observation in many localities. Results will be watched with great interest.

In addition, a great deal of work has been done in developing a preservative treatment to prevent the attack of the borers. This consists in impregnating the pile with creosote or dead oil of coal tar. When the piles are open-grained, and the oil has been of a proper quality and has been correctly injected, this plan has probably given the best results. It is true that a great many piles treated with creosote have been attacked by marine borers and destroyed, but in such cases there is usually a good reason to account for the failure. For instance, the use of timber of such density that the preservative cannot be forced into it, the use of green timber, the lack of sufficient preservative, or the use of a preservative of inferior grade may prevent the treatment from being completely successful.

Along the Pacific coast, particularly in California, large quantities of yellow pine are found. This timber embodies all of the characteristics of a good pile timber, with the one exception of durability. Western yellow pine is open-grained, and lends itself readily to a successful preservative treatment with creosote. There is no good reason, therefore, why this timber should not be used to replace Douglas fir wherever the yellow pine can be obtained at a reasonable cost. Details of the work of the Forest Service along this and similar lines can be obtained on request from the Forester, at Washington.

Tools and Equipment in Structural Shops

A PLANT showing a balance at the end of the year is supposed to be successful in a way, yet that is far from being true. In the fabricating business there are some rather primitive shops competing, even in shop cost, with some of the best equipped plants. By analyzing the conditions in such establishments the reason can readily be discovered; the shortcoming of the equipment is made up by the higher efficiency in management and men, a condition rather hard to obtain under our present industrial conditions. In any manufacturing establishment there are three elements: Management, workmen and equipment, and any deficiency in one must, in a way, be made up by the others. There is a certain balance between them which must be maintatined to obtain satisfactory results.

Another type of shop which, with limited facilities, enters this apparently successful competition, is the long established concern with men who have been in its service for years, and where any change or improvement in method is frowned upon and where very little new blood is ever introduced. The organization is of the simplest, fixed expenses are low, and the efficiency of the men is high. Such conditions in a shop would be ideal if they did not entail slow but sure extinction in the end; such shops get deeper and deeper in the rut which finally buries them; for years they keep on extracting the vitality of the concern and put nothing in. The company constantly striving for betterment necessarily has higher fixed charges, the up-keep of the plant is more and the depreciation greater; yet if, at the end of the year, it shows no greater money return than the shop cited above, its management has been a success for, instead of losing vitality, it has increased it. This, coupled with the better and superior class of work made possible by the better equipment, ought to prove entirely satisfying to the owners. Improvements should be made gradually; too much new blood and too many rapid changes mean disorganization and friction, and may double the cost of improvements.

Fabricating plants have peculiarities all their own. The problem here involved is one largely of handling and applies not only in carrying material about for the various operations, but the actual operations as well. Positioning a piece in a shear or punch, or for riveting,

*From a paper by Geo. P. Thomas before the Engineers' Society of Western Pennsylvania.

takes greater time than the actual performance of the work. The efforts to reduce costs in machine shops are made largely by aiming to reduce the time of operations by improved and more powerful tools, by increasing cutting speeds, and by using high speed steel, jigs and other time-saving appliances. In fabricating shops the aim has been almost exclusively to lessen the time to position the material for the required operation and for removing it. In a modern shop this is in evidence everywhere; in the arrangement of overhead cranes, skids, punches, reaming gantries and special cranes for handling riveters.

In laying out a plant and taking into consideration all the various details, it is very easy to go astray. The shop must be laid out to work almost as a unit and consequently all the various operations must be well balanced and properly located in relation to each other to work on an economical basis. The idea of building a structural plant on a scale for taking care of future growth and equipped only for the present, sounds well in theory, but is not so easy to carry out in practice if efficiency is an object to be obtained. A machine shop or foundry may be added to, from time to time, without destroying the general scheme; but this is almost impossible in a fabricating plant and at the same time keep it properly arranged and not disturb the equipment already installed. In a progressive shop the continual growth and the gradual changes in the management, men and methods, make the laying-down of a shop scheme, to be carried out in the distant future, an altogether uncertain quantity, and is seldom completed as originally planned. Better results are obtained by equipping for the present, allowing the future to care for itself. Providing equipment for extremes is also wrong; for instance, to provide a 10-ton crane where 95 per cent of the lifts will not exceed 2,000 lbs., as in the marking, shearing and punching area. Cranes of ample capacity should be provided, but far better results are obtained by installing cranes adapted for the higher lifts and dividing the loads for the heavier ones. This applies also to machine capacity.

The aim in a modern plant is to keep the material always moving forward from one operation to the next. Return movements will occur, but they should be the exception and not the rule. As previously stated, to obtain the highest efficiency the shop must work as a unit, and makes location of sections in relation to each other important. Local conditions usually affect the shop plans more or less, but the best conditions are obtained when the storage yard can be located at the entering end of the shop and the loading yard at the finishing end with narrow gauge tracks connecting the two. Some shops have tracks running into the shop from the storage yard on a slight down grade, permitting loaded cars to run into the shop by gravity. If, from the arrangement of the plant, an outlet for material must be provided through the storage yard, a parallel level track can be provided.

The first group of operations in the shop are marking, shearing, punching and storing. The storage space for punched material practically makes a division. Beyond the storage space the assembling, reaming, riveting, finishing and other necessary operations are suitably located. To keep track of material as it is received the storage yard is usually divided into numbered sections. The foreman receives material sheets for each contract with blank spaces for date when received, number of yard section in which material is stored, and date when finally delivered to the shop. In the best shops the marking and shearing operations are placed together. Material brought in on a narrow gauge car from the yard is handled by overhead cranes and placed on storage skids, which should be provided throughout the shop, and nothing should be placed on the floor except such pieces as can be handled without a crane. Skids for storage should be from 10 to 12 ins. high; for marking, about 28 to 30 ins.; for punches, usually the same height as the die, about 28 to 30 ins.; for assembling, 20 to 24 ins. For serving shears a combination of rollers and skids is used in many shops. Skids facilitate the handling of material throughout in bulk, as well as in detail, and to keep the shop in an orderly appearance they should be anchored down tight.

Many shops simply range their machines along the wall and provide overhead slings to feed them, with a traveling crane covering the whole floor space to bring material and carry it away. With this arrangement the most valuable part of the shop is not utilized except for storage of material. In some cases punches are located in the center of the shop, roll-tables being used instead of slings; but if many machines are to be served the overhead crane cannot possibly keep them going. Another system adopted by some of the leading shops is to run special cranes transversely to serve all tools as well as punches, and permits a better arrangement of tools and saves space. It does not, however, provide any means for transferring material forward, and for doing this narrow gauge cars must be used. Carrying material in bulk in the punch shop or providing means for carrying stuff from one end of the shop to the other is not so much desired as the prompt serving of tools and in a properly arranged shop such movement of material should be a rare exception.

To get the best results from each punch, they should be specialized as much as possible, keeping each machine on one class of work as much as conditions will permit. The serving of punches is receiving more and more attention. The feeding apparatus is of as much, if not of more, importance than the punch itself. Roll-tables used with a punch equipped with a gag, and controlling the material with a hand lever, give excellent results, and are a step in advance of the overhead sling and trolley besides permitting a more suitable crane system to be installed and a better arrangement of machines on the floor. The ideal way of punching material is with a spacing table, a suitable machine of this kind eliminating

many difficulties and is one of the most important tools in the shop. It reduces the templet making, eliminates marking, does better punching and more of it at less cost on account of the regular spacing of holes, and effects considerable saving in assembling and reaming.

Punching has many mysteries of its own, the behavior of the material being the source of much trouble, and the curving of angles particularly troublesome. Straightening is not only a slow and tedious job, but stretches and strains the piece, changes the spacing of holes, gives trouble in assembling, necessitates reaming and affects the elastic limit of the material to some extent. In designing attention is seldom given to this treatment of the material; it is considered a sort of unavoidable evil necessary in fabricating. Plates also stretch in punching, particularly thick and narrow cover or universal plates, the stretching varying with every plate or shape. There are several causes for this trouble aside from the mere thickness of the metal. In rolling the heavier sections retain the heat longer and are finished at a higher temperature than the thinner ones, resulting in a lower elastic limit and leaving the metal softer and with a greater tendency to stretch in punching. Pieces having the same section will also show variations due, more or less, to rolling at various temperatures. The shape of the punch also has some bearing on this. Many shops use punches with slightly convex ends to strengthen the cutting edge, thereby greatly increasing their life. This shape creates a slight tendency to drift the material away from the cutting edge and to stretch the material all around the hole; but such punches are very hard to strip unless well greased.

Some years ago I made some experiments to determine how much the shape of the punches affected the stretch of material, and I found that convex ends increased the stretch very materially and was still further increased by the shape and the size of the centering tip. Flat punches were much better and made a cleaner hole, while punches with a slightly concave point punched a hole almost as clean as a drilled hole and freed themselves without a stripper. In punching thick angles with such punches the curving is not entirely eliminated, but is greatly reduced. They are not practical, however, for general use, the edges breaking off rapidly after punching several hundred holes, where 2,000 to 4,000 holes are obtained with standard punches. On a spacing table the tendency to stretch can be reduced by using flat punches made with a slight clearance and without a tip; a clean-cut hole is produced and strips easily. The elastic limit and the degree of hardness of ordinary open hearth steel vary greatly, and every shop superintendent knows that no two pieces are ever found alike, varying from extreme softness to a glass-like hardness, in some cases flying to pieces in punching, or cracking all around the hole. In punching thin plates or shapes, which are very apt to be hard from rolling at low heat, the hardness is indicated by the loud report made by the punch in going through the material.

Next to the punching comes the storage for punched material. The importance of providing ample storage space for punched material other than details, is not appreciated in many shops. The details should be sheared, punched and stored with a view of avoiding the necessity of carrying them about. Many managers prefer to segregate this part of the work in a small building by itself. In my opinion this is not necessary, as the storing of the details should be located not far from the assemblers or as close to them as possible. This storage space can, like the storage yard, be divided into numbered sections and material delivered there can be easily located; the foreman in charge of the punch shop can trace it from the time it is received from the storage yard until it passes out of his hands into the storage space ready for the assemblers. Low-level skids about 8 ins. to 10 ins. high should be provided for the shapes and narrow plates. Wide plates should be stored on edge rather than flat-wise, as the plates on the bottom of a pile are usually wanted first. Then again, there are several other advantages, space is saved, plates are not so apt to be bent in handling, and they can be picked up by crane more easily. A good means of storage can be had by providing strong posts placed in rows with about 18 in. spaces and from 3 to 4 ft. apart, the height being governed by the width of the plates. For handling, a yoke fitted with a pin, is slipped over the plate at its center, the pin engaging one of the edge holes, the yoke being left on the plate until it is delivered to the assemblers. Plates stored in this manner can be shuffled like the leaves of a book and any one may be picked out without disturbing the others.

The assembling should be close to the storage space. Good strong skids 24 ins. high, topped with about 70-lb. rails and spaced about 6 ft. apart make a very good arrangement. They provide a level space for the assembling of material and avoid the danger connected with the use of wooden horses which are in every way unsatisfactory. In some shops a space on the floor is provided for assembling large girders. Plates provided with T slots are located about 10 or 12 ft. apart, resting on concrete piers and all carefully leveled. In this way the assembling of girders is greatly simplified, any desired camber being quickly obtained by blocking up the bottom chord. The arrangement for reaming and riveting is largely affected by the system of crane adopted; reaming and riveting gantries permitting better use of the floor space and allowing a better arrangement and division of the tools. An overhead trolley is just as good to handle a riveter, but when located in the middle of the floor it interferes with the overhead cranes and it is impossible, unless the shop be pushed to extreme lengths, to get sufficient wall space to locate all operations along the wall. It is not a question as to whether a gantry or overhead crane is the better system of handling or serving riveters, but simply "Which will use all available floor space to the best advantage?" Riveting, like punching, has many problems—crane system, rivet-

ers, furnaces—matters on which no two engineers or shop managers can agree.

The end to attain, of course, is to drive tight rivets at as low a cost as possible. Much of the trouble with loose rivets is caused by the carbonizing and scaling of the commonly used soft steel rivet in gas furnaces. In the Pittsburg district many firms make their own rivets, heating the bars in a natural gas furnace and incidentally soaking in carbon and making a hard steel skin varying in thickness according to the time exposed. Again, this process is continued when heating rivets for driving, being allowed to soak in the furnace sometimes for hours before being used, the amount of carbon absorbed being so great that the rivets are practically hard steel. Carbonized rivets, even if highly heated, are very hard to drive; the metal does not flow in upsetting, the button sets are quickly worn and the wear on the riveter is greatly increased. In driving the rivets the metal is upset first where the pressure is directly applied. As one head of the rivet is already formed and the die fits this head snugly, the upsetting first begins at the extreme end, gradually forming the head as the riveter closes, the upsetting of the body to fill the hole being last. This is the principal difficulty, the body is the last to receive the pressure while it is the first to begin to cool from coming into contact with the plates. Combining this tendency to cool rapidly in the hole, with rivets having a hard steel surface from absorbing carbon in heating, more or less trouble can hardly be avoided. To avoid carbonizing altogether involves problems in furnace construction; the rivets should not be allowed to come into contact with the flames. To remove the scale is also a factor to consider, and I believe it would pay to pickle the rivets, the cost incurred being saved in the repairs of the upsetting dies.

Structural material costs about two and one-half or three times as much as the fabrication. If a modern plant does not reduce the cost of fabricating, it will produce a better class of work which will permit a higher factor of safety to be used and as a direct result a saving in material is made possible. This is of greater consideration than the mere reducing of fabricating cost.

While material should be punched so as to decrease stretching and overcome initial strains, the holes so spaced that they match, and due care taken in riveting, an increased factor of safety should be allowed where the material is stretched and strained in punching and straightening, drifted in assembling, and poorly riveted. In former days almost any kind of work was permitted in boiler construction, the sheets being strained in punching and pulled and stretched by drifting where holes did not match. The result was that, although there was plenty of metal used, the boilers were weak. Boiler explosions, many of them disastrous, made better workmanship a necessity, and care is now taken to avoid initial strains, drifting is not allowed and the riveting is carefully done. Stronger and safer boilers are built, not so much from the increase in weight of the material used as from superior workmanship, and I believe this is worthy of consideration in the fabricating shop.

The first cost of tools is not so much a consideration as what the cost of maintenance will be in proportion to results obtained. Into this also enters the personal element that is to run the shop. The study of social questions in connection with the engineering of the plant usually receives some consideration, but it should receive far more than it does. Careless and inefficient management fosters that indifferent spirit so much in evidence in some shops. The direct fruit of this is low efficiency per man, inferior work, abuse of tools and machinery and waste of supplies. There is no doubt but that a careful and considerate management, while it will not entirely eliminate this, will greatly reduce it.

More Locomotives and Cars

A contract to furnish ten 40-ton 6-wheel connected, saddle tank locomotives for the work at Porto Bello has been awarded to H. J. Porter & Co., of Pittsburg, the lowest bidder. These engines are to be 3-ft. 6-in. gauge, with wheels 40 ins. in diameter, cylinders 15 ins. by 20 ins., tractive force 15,000 lbs., and boilers carrying 160 lbs. pressure. They will operate from the quarry at Porto Bello to the crushers on a 2½ to 3 per cent grade, will run on a 20-deg. construction track, and will haul about 600 yards of stone, weighing 2,900 lbs. to a yard. They will be constructed along the latest designs for this class of engine, including an air brake rigging which will meet the interstate commerce regulations. Locomotives of this type are in general service in the states in similar classes of work.

A contract has also been let for 50 6-yard, all metal dump cars, the lowest bidder being Vermile & Powers, of New York City. These cars are to be similar in construction to the 12-yard Oliver and Western dump cars now in use. The cars will be 15 ft. long, 8 ft. wide, equipped with Tower M. C. B. couplers and Westinghouse automatic air brakes. They will be of exceedingly strong construction, in order to stand the hard usage given cars on the Isthmus.

Bids have been asked for 200 dump cars similar in construction to the 12-yard Oliver and Western dump cars, now in service on the Isthmus.—The Canal Record.

Railway Ties in Switzerland

In a recent consular report concerning the kinds of railway ties in use in Switzerland, Vice-Consul George J. Frankenthal, of Berma, makes the following statement:

Aside from the usual iron and wooden railway ties only a few reinforced concrete ties are in use, and these simply as a trial under the direction of a Geneva engineer, who delivered them to the Swiss Federal railways. It appears to be too early to give any opinion as to their value.

The ties ordinarily used on the Federal railways are: Iron ties, about 8 ft. 10 ins., weighing 150 lbs., manufactured in Germany, and costing $2.13 delivered at Basel; oak ties, same length, 6 ins. high and 10 ins. high, made in France and Switzerland, and costing $1.80; beech ties, same dimensions, made in Switzerland, and costing $1.61; and fir ties, same dimensions, made in Switzerland, and costing $1.26.

The wooden ties are all impregnated with tar oil. On the secondary roads similar ties are used, but about 10 ins. shorter, the cost being relatively smaller. [Copies of two Swiss patents for fastening rails upon a concrete roadbed or groundwork, and for railroad ties of reinforced concrete, transmitted by Vice-Consul Frankenthal, are on file in the Bureau of Manufactures.]

Winnipeg Union Station and Terminal

WORK has been started at Winnipeg, Man., on a union passenger station and terminal yard to be used by the Canadian Northern and Grand Trunk Pacific roads. The general layout is shown by the accompanying drawing. The terminal is located near the center of the city, lying between Water street on the north, the Assiniboine river on the south, the Red river on the east, and Main street on the west. The property is on the site originally occupied by Old Fort Garry, erected in 1812.

The location of the passenger station with relation to the terminal is shown by the illustration. This will be a stone structure 350 ft. long, 140 ft. wide and three stories high over the basement, for the larger part of the building, with provision for an additional three stories at such time as they may be required. The contract for this structure has been let to Peter Lyall & Sons, Montreal, at the price of $886,000. It is estimated that in addition to this the cost of furnishings and fixtures will be about $40,000 for the first story and about $200,000 more for the two upper stories.

There will be a rectangular central portion of commanding height, with arched windows on all four sides, and this will be surmounted by a dome 100 ft. high above the street. The main entrance will be on Main street, at the center of the building, under a large arch with massive stone columns on each side projecting 10 ft. beyond the building walls.

The station facilities will be on the main floor at the street level. The details of the design we take from a description recently published in the Railway and Marine World, of Toronto. The main floor plan is carefully designed for convenience to passengers, and facility of operation.

On the north side of the ticket lobby space will be provided in each corner for telephone and telegraph booths and newspaper and book stands. Passengers who must wait for trains may pass through the north side of the ticket lobby into the waiting room, which has an area of 9,000 sq. ft. By this arrangement of having the waiting room adjoining and separate from ticket lobby, a quiet and orderly waiting room will be assured, as all passengers going to and from trains may pass directly through the unobstructed ticket lobby without entering the waiting room. The confusion incident to having both moving and waiting passengers together will be effectually prevented by this arrangement.

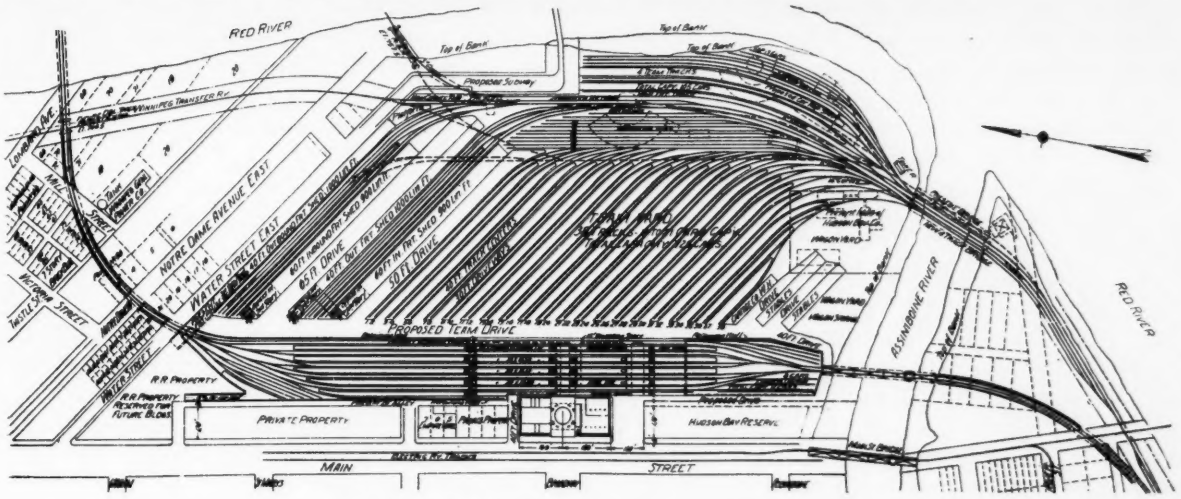
The central portion of the waiting room will be covered over by an arched skylight 40 ft. wide by 100 ft. long, above which will be an open court, thus providing the waiting room with excellent light. A special feature has been made of the construction of these skylights. They will be composed of vault light in panels and made watertight, which, in a region of heavy snowfalls and extremes of temperature will prevent the annoying leaks and draughts incident to large skylights of ordinary construction in such climate.

The entire south wing of the main floor will be occupied by the baggage room, area 8,000 sq. ft., and the express room, area 8,000 sq. ft. In the future, when more space is required, both the baggage and express will occupy space beneath the tracks and platforms adjoining the rear of the building, as shown by the track layout plans. The space at first occupied by them in the building may then be used for additional waiting room space, if considered desirable at that time, or for other station purposes. The central portion of this wing will be covered by an arched skylight similar to that over the waiting room in the north wing, there being an open court in the interior of this wing also.

A driveway for baggage and express wagons will be provided at the south end of the building. The level of this driveway will be 3½ ft. below the level of the main floor, and will be reached by a short 5 per cent grade down from Main street. The wagons will be loaded and unloaded on an 8-ft. platform outside of the building wall, which will span the basement area away below. The baggage and express will be handled by hand trucks between the building and the train platforms, through trucking subways beneath the train sheds, and by electric elevators from the subways to each platform at either end of the train shed.

The basement floor will be 15 ft. below the level of Main street. The entire north wing of this floor will be devoted to immigrants. In the north wing of the basement floor, at the southwest corner, a barber shop will be provided, area 1,300 sq. ft., which can be reached by stairways from both Main street and the main vestibule of the building. The remainder of the west side of the wing will be occupied by the kitchen, area 6,000 sq. ft., which will supply the restaurant and luncheon rooms directly overhead. The remainder of this wing will be occupied by the boiler and engine rooms, also heating and ventilating apparatus. There will be four boilers, 130 h. p. each, provided for heating purposes. Under the central portion of the building the basement floor will be used for storage of sleeping and dining car supplies, and mis-

*From the London Times Engineering Supplement.



NEW WINNIPEG TERMINAL AND UNION STATION FOR THE CANADIAN NORTHERN AND GRAND TRUNK PACIFIC.

cellaneous storage purposes. The basement will be surrounded on all four sides by an open areaway 10 ft. wide, which will supply light and air to the basement rooms.

The second, third and fourth floors will be occupied entirely by the local and general western offices of the Canadian Northern, the G. T. Pacific, and the National Transcontinental railways. These offices will be on either side of a corridor, the interior row of offices in each wing facing on the open court. Each floor will provide an available office space of 25,000 sq. ft., exclusive of corridors, stairways, elevators and toilets. Provision has been made in the design of the foundations and the steel structure for the future addition of five office floors, so that the building will then be capable of providing 200,000 sq. ft. of available office space.

The building is so designed that there will be no necessity for artificial lighting in any portion during the day. The electric lighting of the main floor has been artistically arranged. In the ticket lobby the lamps for the greater part will be concealed, the interior of the vast dome being illuminated by the brilliant reflected light from these invisible lamps. In addition, there will be a large chandelier, containing 150 lights, suspended above the center of the lobby. A special feature has been made of the heating and ventilating layout. The heat will be supplied by a hot water system, using the indirect method on the main floor, and the direct method on the office floors.

The structure of the building will be of the steel skeleton type. The column loads will be supported at the foundations by concrete piles, each pile designed to carry a load of 40 tons. The character of the soil at the site is the blue clay common to Winnipeg, the supporting power of which cannot be relied upon to sustain a greater load than 3,000 lbs. to the square foot. The use of concrete piles will be necessary, owing to the fact that they will lie between the high and low water lines of the Assiniboine river, which is about 1,000 ft. from the building site. The stone used in the construction of the facades will be either Indiana limestone or the native Tyndall Manitoba stone.

In the space allowed for the various rooms of the station, and also in the design of the passenger track layout, ample provision has been made for the probable rapid growth of Winnipeg, and the consequent increase of requisite station facilities and traffic.

PASSENGER YARD AND TRAIN SHED.

The track layout for both the passenger and freight yards, as shown on the accompanying plan, was developed after much study by the engineers and other officials of both railway companies in co-operation with the architects. Several preliminary layout plans showing the various types of passenger terminals were made and studied. It was finally decided that a layout of the through station type, with approach tracks elevated over the intersecting streets, and with tracks raised sufficiently above main floor of the station to allow a passenger entrance subway beneath, was the most desirable, giving the greatest operating efficiency for the present and prospective traffic to be handled at Winnipeg, as well as providing the greatest convenience to passengers.

The plan shows the maximum development of the passenger terminal layout, which will consist of eight through passenger tracks, with adjacent platforms will be of re-inforced concrete construction, the rear for through freight trains. The platforms will be 20 ft. wide, and can be made 1,650 ft. long. By means of this great length, and by the use of the double crossovers, each track will be capable of handling two trains of 11 cars each during periods of heavy traffic. The total capacity of platforms will be two hundred 70-ft. cars. The platforms will be of reinforced concrete construction, raised 1 ins. above base of rail. Between each pair of tracks there will be three lines of pipe for water, steam and gas. Passengers going to trains will pass from the rear of the ticket lobby into a 50-ft. wide subway, with head room of 10 ft., having stairways 7 ft. wide on each side, leading up to each platform. This subway will be so arranged by means

of railings and gates that there will be no interference between passengers going to trains with those coming from trains. The subway will be heated in winter from the building. The elevation of tracks over the subway will be 10 ft. above the level of the main floor of the station. A slight ramp down from the rear of the ticket lobby to the floor of the subway will allow a clear head room of 10 ft.

As already described, the baggage and express business will be handled for the present in the south wing of the station building. In the future, however, these facilities will occupy space beneath the tracks, as shown on the plan, the tracks being carried overhead by steel viaduct construction. The south wing of the station need then contain only a baggage checking counter for the convenience of passangers, with pneumatic tube connection with the baggage room. The remainder of this wing will be used for any other station purpose desired. All the sheds beneath the tracks will have a clear head room of 10 ft. They will be approached from a 50 ft. driveway, 3 ft. 6 ins. below the floor of the sheds, with a 4 per cent grade down from Main street, south of the station building. On the south side of this driveway will be the express sheds, one for each road, with an available floor space of 15,000 sq. ft. in each shed. On the north side will be the baggage room, with an available floor space of 20,000 sq. ft., also the mail room, with 10,000 sq. ft. On both the express and baggage sides of the drive there will be a row of electric elevators, one to each platform. These lifts will supply all trains departing for the west and south and arriving from the east. The fact that the largest portion of all express business handled at Winnipeg arrives from the east and departs to the west, determined the location of sheds on this side of the train shed. To supply the east-bound departing trains and the west-bound arriving trains, the baggage and express will be handled through a 15-ft. trucking subway at the rear of the train shed to a row of elevators on the north side of the train shed. By these arrangements there will be no necessity for trucking of any kind being done on the train platforms, thereby affording the passengers the unobstructed use of the platforms, and avoiding all interference and confusion. This system of handling baggage, express and mail beneath the tracks, with elevators to each platform, is in successful operation at some of the largest passenger terminals in the United States, notably the union station at St. Louis, the La Salle station at Chicago, the union station at Washington, D. C., and the Pennsylvania R. R. station at Pittsburg. Similar systems of baggage and express handling are also successfully used in many of the large railway terminals in Europe.

APPROACHES TO PASSENGER TERMINAL.

The west approach will start from the present main track on the north bank of the Red river about 2,000 ft. west of Main street, and descending on an earth embankment at a maximum ruling gradient of 0.4 per cent, will pass over Main street on a double track plate girder bridge, allowing an underclearance of 14 ft. for the street roadway. It will then cross the Assiniboine river on a new double track steel truss bridge 40 ft. long, one span of which will be a swing bridge, as required by the Dominion government. The east approach will start from the present main line, near St. Boniface station, and, rising on an earth embankment, with the ruling 0.4 per cent gradient, to the Red river, which it will cross on a new double-track steel truss bridge 900 ft. long, containing one draw span, as required by the government. It will then cross, on steel plate girder bridges, the Winnipeg Transfer Ry., Mill street, Notre Dame street, and Water street. Each of the street roadways will have at least 14 ft. clear head room. The proposed base of rail will be practically level from the Red river bridge to the Assiniboine river bridge, at elevation of 766.0, which is approximately 10 ft. above the level of Main street. At each end of the passenger layout there will be a signal tower located as shown on the plan, from which all signals, switches and cross-overs will be controlled. The electro-pneumatic system of interlocking will be used. All track work will be of first-class construction, with 80-lb. rails and gravel ballast While the government requires all bridges across either the Red or Assiniboine rivers to contain draw spans, these rivers are not navigable at the present time for any but small boats, and the draw spans are open only a very few times in the course of a year, but on the completion of the St. Andrew's locks below Winnipeg, there will doubtless be a considerable increase in the navigation of the Red river.

LOCAL FREIGHT YARDS AND FREIGHT SHEDS.

The problem of obtaining a layout for local freight delivery yards and freight sheds to give sufficiently large team track capacity, long freight sheds, and equal facilities for each road, and allowing greatest accessibility for teaming, as well as one that could be properly worked by switching, was complicated by the peculiar shape and conditions of the layout, and by the fact that the throat of the yard had to be located on a bridge across the Assiniboine river

The team yard will contain 42 tracks, with a total capacity of 830 freight cars. The switching leads to the team yard will be divided by cross-overs into three separate portions, each controlling 13 tracks, so that three switching locomotives may be worked at the same time. The usual length of team tracks will be 800 lineal feet, with a capacity of 20 cars each. The team driveways will be of stone block construction on a 6-in. concrete base. This construction is made necessary by the treacherous character of the clay soil, which, when wet, will heave and swell, causing an ordinary light pavement to break and disintegrate. The driveways will be 30 ft. wide between curbs, the opposite tracks being 40 ft. centers across the driveways. Adjacent pairs of team tracks will be on 12-ft. centers. Tapping the ends of these driveways there will be a paved avenue 60 to 70

ft. wide, running the full length of the yard. This avenue will be accessible from Water street on the north, passing beneath the bridge carrying the east approach overhead, and from Main street near the Norwood bridge on the south, passing beneath the south approach.

The surface drainage will be by means of gutters along each side of each driveway, ending at catch basins located at the ends of the driveways on each side of the wide avenue. These catch basins will discharge into a line of vitrified tile pipe running beneath the wide drive, and discharging into the Assiniboine river.

The freight shed layout will consist of two equal sets of inbound and outbound sheds, one set for each road. The outbound sheds will be 40 by 1,000 ft., each served by four tracks. The inbound sheds will be 60 by 900 ft., each served by two tracks. Between these inbound and outbound tracks there will be a 10-ft. transfer trucking platform. Each road will therefore have a freight shed track capacity of 144 40-ft. cars. The freight sheds will be one story high, having steel columns and roof trusses, with sliding doors on both the track and team sides, so that any portion of the shed may be opened. Above the doors there will be a transom of wire glass. The roofs will be of tin. The floors will be of concrete laid on a compacted cinder fill.

At the ends of the freight sheds, adjacent to the wide avenue, ample provision has been made for the freight offices. These will contain 15,000 sq. ft. of available office space for each road, and will be in the second story above the main floor of the shed. A bridge 40 ft. wide at the level of these office floors will span the six intermediate tracks, and connect the outbound and inbound sheds. The freight agent's office will be located in this bridge, where he can view the loading and unloading of cars. The switching leads to the freight sheds will be of such length that the tracks may be switched without the switch engine having to cross the bridge at the throat of the yard. The supporting yard will have a total capacity of 385 cars. This yard will be for the reception and storage of arriving trains of loaded cars to be switched into the team yard and for departing trains of empty cars which have been switched out from the team tracks. This layout of team and supporting tracks and freight houses will be one of the largest local freight delivery yards in existence. A connection will be maintained with the present Winnipeg Transfer Ry. track, along which are located numerous industrial sidings, and over which cars for transfer with the Canadian Pacific Ry. are handled. This connection will pass beneath the east approach near Lombard avenue.

The present main track crosses the Assiniboine river on a wooden drawbridge, which will be replaced in the new scheme by a steel four-track rolling lift bridge having two separately operated leaves. The Red river is crossed by the present main track on a comparatively new steel truss bridge. This bridge will be maintained for the proposed new layout, and used mostly by the G. T. Pacific Ry. trains, for local freight running between this terminal and that company's general freight yard located about three miles east, as noted further on. The adjacent shore span will need to be reconstructed to meet the change in alignment of running track as shown. This track will pass over the east end of Water street on a plate girder bridge, the street being somewhat depressed to pass under. The driveway across the Broadway bridge over Red river will be maintained as at present. The west approach to the freight yard will use the same line and be at the same level as the present main track. The length of all switching leads for each part of the freight yards is such that no switching whatever will be done across Main street. The only traffic across this street will be that of trains of local freight between this terminal and the Canadian Northern Ry. general freight yards, one mile west, as noted further on. All the through freight trains for both roads will be run on the proposed new overhead line, passing around the rear of the train shed on the two open running tracks provided for that purpose.

At the north end of the new Assiniboine river bridge there will be located a signal tower, from which will be controlled, by the electro-pneumatic system of interlocking, all the signals, switches and crossovers of the tracks entering the bridge. The sharpest curves used in the layout are 14 degs., radius 410 ft. The frogs used are mostly No. 7, with No. 10 for main track connections and main crossovers. The track construction in freight yards will have 60-lb. rails and gravel ballast.

As the railway companies will each have its own cartage company to handle all trucking from freight sheds, as well as a large amount from the team yard, there will be provided, adjacent to the team yard, two stable buildings, each to accommodate 200 horses. The buildings will be of brick construction two stories high, the upper floor being used for feed and harness storage. A cartage company warehouse of brick construction will also be provided for the storage of freight not claimed by consignee within a reasonable length of time.

Each of the joint railways will use its own passenger coach yards, locomotive houses and shops, in conjunction with these terminals. Those for the Canadian Northern Ry. have recently been constructed about a mile west of the new station, and those for the G. T. Pacific Ry. are now being constructed about three miles east of this station. The general receiving, distribution and forwarding freight yards of each road are also located at the above points.

The railway officials who co-operated for the construction of these joint terminals, and who personally rendered valuable assistance to the architects in their work of designing the terminals, are: Wm. Mackenzie president; D. D. Mann, vice-president; and M. H. McLeod, general manager, of the Canadian Northern Ry.; C. M. Hays, president; F. W. Morse, vice-president and general manager; and B. B. Kelliher, chief engineer, G. T. Pacific Ry. Warren & Wetmore, of New York City, are the architects who have had charge of the design,

and who will supervise the construction of both the station building and the track layout of passenger and freight yards.

Testing Wood

A new line of work, consisting of the microscopic examination of wood after it breaks in a testing apparatus, has just been started by the office of wood utilization in the United States Forest Service.

The structure of wood is complex. Every species has several different kinds of cells, each of which has its own size and form. There is also a wide variation in the number and arrangement of the cells in different species. These differences in structure have their bearing on the strength of the wood.

For some time past the Forest Service has been carrying on a large number of tests on many kinds of wood in order to determine their strength, stiffness, elasticity and other physical properties, so that they may be used to the best possible advantage in construction.

Other problems connected with the structure of wood, such as the preparation of wood pulp and the treatment of wood with preservatives, will no doubt be aided by this new study.

Non-Explosive Gasoline Tanks

RAILROAD and shop men will be interested in demonstrations recently made by the Universal Safety Tank and Can Co., of Chicago, in which were shown gasoline tanks on fire with no explosion attendant therewith. The device is intended to be applied to automobiles, launches, gasoline and oil stoves, gasoline lighting and power plants, tank cars, and in fact wherever liquid explosive is used. The business of the company is manufacturing safety cans and tanks to which is attached the company's patent non-explosive valve, making evaporation of any liquid contained in the can an impossibility. The company also manufactures safety gasoline cans for all purposes, a can which cannot possibly explode and which, if lighted, will merely burn out as a torch.

The importance of this invention cannot be overestimated when it is considered that a large proportion of the mysterious fires that destroy millions of dollars' worth of property and hundreds of human lives annually in the United States is due to evaporation of gasoline and other liquid tanks, the formation of a high explosive by admixture of the vapor with the atmosphere in inclosed spaces, and then ignition from a gas jet or a carelessly lighted match.

This is the history of so many hundreds of explosions and destructive fires annually that the insurance companies and business interests of the country generally are eager to adopt any safety contrivance that is shown to be effective. The National Board of Underwriters has recommended the invention and sanctioned its use.

The effectiveness of the non-explosive tank was very strikingly demonstrated, for it burned up and fell apart, after the heat surrounding it had forced open the patent valve and burned all the gasoline.

The Non-Explosive Can Company has charge of the sales of these cans and devices, attachments for storage tanks, tank cars, etc. Any information will be furnished by Mr. Allan F. McIntyre, manager railroad department, 522 Monadnock block, Chicago.

FILLING TANKS THROUGH A FLAME.

Price on Track Material, F. O. B. Chicago

Steel rail, 60 lbs. and over	$28.00 per gross ton
Steel rail, 25 to 45 lbs.	26.00 per gross ton
Steel rail, 20 lbs.	27.00 per gross ton
Steel rail, 16 lbs.	28.00 per gross ton
Steel rail, 12 lbs.	29.00 per gross ton
Ties, 6x8x8 oak, 1st grade	74c each
Ties, 6x8x8 oak, 2d grade	67c each

Angle bars, accompanying rail orders, 1908 delivery, 1.50c; car lots, 1.60c; spikes, 1.80c to 1.90c, according to delivery; track bolts, 2.10c to 2.15c, base, square nuts, and 2.25c to 2.30c, base, hexagon nuts. The store prices on track supplies range from 0.15c to 0.20c above mill prices Switch set per turn out, 60-lb. rail, $85 to $90.

Old steel rails, rerolling	$16.00 to $16.50
Old steel rails, less than 3 ft.	14.75 to 15.25
Old iron rails	18.00 to 18.50

SHEET STEEL.

It is quoted for future delivery:

Tank plate, ¼-in. and heavier, wider than 6¼ and up

to 100 ins. wide, inclusive, car lots, Chicago, 1.78c; 3-16 in., 1.88c; Nos. 7 and 8 gauge, 1.93c; No. 9, 2.03c. Flange quality, in widths up to 100 ins., 1.88c, base for ¼-in., and heavier, with the same advance for lighter weights; sketch-plates, tank quality, 1.88c, flange quality, 1.98c. Store prices on plates are as follows: Tank plate, ¼-in. and heavier, up to 72 in. wide, 2.00c to 2.10c; from 72 to 96 ins. wide, 2.10c to 2.20c; 3-16 in. up to 60 in. wide, 2.10c to 2.25c; 72 ins. wide, 2.30c to 2.40c; No. 8 up to 60 ins. wide, 2.10c to 2.15c; flange and head quality, 0.25c extra.

STRUCTURAL STEEL SHAPES.

Store quotations are at 1.95c to 2.00c, and mill prices are as follows: Beams and channels, 3 to 15 ins., inclusive, 1.78c; angles, 3 to 6 ins., ¼ in. and heavier, 1.78c; larger than 6 ins. on one or both legs, 1.88c; beams, larger than 15 ins., 1.88c; zees, 3 ins. and over, 1.78c; tees, 3 ins. and over, 1.83c, in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations per net ton on water pipe, 4 ins., $27; 6 to 12 ins., $26; over 16 ins., $25; with $1 per ton extra for gas pipe.

CEMENT.

Good grade Portland cement, car lots....$1.65 per bbl.*

*(Four sacks per bbl. credited 10c. each when returned in good condition.)

SAND.

Bank sand, car lot .....$0.75 per yd.
Torpedo sand, car lot ..... 1.15 per yd.

CRUSHED STONE GRAVEL.

Crushed limestone, car lot .....$1.05 per yd.
Crushed gravel, car lot ..... 1.10 per yd

Personal Mention

Mr. E. B. Espenshade, division engineer and bridge inspector of the Chicago, Cincinnati & Louisville R. R. at Chicago has resigned and Mr. Geo. S. Foster has been appointed to succeed him.

Mr. E. A. McFarland, chief engineer of the Southern Pacific lines in Mexico, has resigned. Mr. R. M. Drake, assistant chief engineer, will succeed Mr. McFarland.

Mr. P. S. McGeeney, superintendent of track laying and minor construction on the Colima and Manzanillo extension of the Mexican Central Ry., has been made general road master of the Cuernavaca division of that road.

Mr. Eldredge H. Beckler died recently at Missoula, Mont. He was chief engineer of the Great Northern Ry. during the construction of that line across the Rockies, and later was in the engineering department of the Chicago & Northwestern Ry., leaving that road to form a connection with Winston Bros. & Co., Minneapolis, Minn., contractors in railway construction work. For them he built the Pierre, Rapid City & Northwestern Ry., and upon its completion took charge of the construction of the mountain section of the Chicago, Milwaukee & St. Paul Ry., having especial charge of the tunnel work on that line, with headquarters at Missoula.

The Pan-American R. R. has announced that, the departments of way, bridges and construction are under the direct supervision of Mr. Geo. W. West, chief engineer, with office at San Geronimo.

Mr. S. C. Grant has been appointed signal supervisor of the Nebraska division of the Union Pacific, succeeding E. W. Kolb, resigned.

Mr. S. E. Hanna, division engineer of the Memphis division of the St. Louis, Iron Mountain & Southern, has been appointed division engineer of the Missouri division, with office at DeSoto, Mo., succeeding E. C. Welch, transferred. Mr. R. C. White succeeds Mr. Hanna, with office at Wynne, Ark.

Mr. E. A. McFarland, chief engineer of the Sonora Railway, the Cananea, Yaqui River & Pacific, the Arizona Eastern, the Gila Valley, Globe & Northern, the Arizona & Colorado, the Maricopa & Phoenix and the Phoenix & Eastern, has resigned, and Mr. R. L. Drane, assistant chief engineer, will for the present report to Epes Randolph, president.

Mr. W. C. Smith, engineer in charge of maintenance of way of the Northern Pacific, with headquarters at St. Paul, Minn., will hereafter have jurisdiction of the lines east of Trout Creek, Mont. Mr. A. R. Cook, division engineer at Tacoma, Wash., has been appointed engineer in charge of maintenance of way of the lines west of Trout Creek, with headquarters at Tacoma, Wash. Mr. B. L. Crosby succeeds Mr. Cook.

Mr. R. M. White, resident engineer of the Delaware, Lackawanna & Western at Buffalo, N. Y., has been appointed division engineer, succeeding G. J. Ray.

Mr. D. P. Beach, engineer of maintenance of way of the Cincinnati & Muskingum Valley, has been appointed engineer of maintenance of way of the Pennsylvania Lines West, succeeding F. H. Watts, at Indianapolis, Ind. Mr. Watts has been appointed engineer of maintenance of way of the Pennsylvania Lines West at Logansport, Ind., succeeding Frank Rhea, resigned.

Mr. H. V. Wallingford, inspector of bridges and buildings of the Atchison, Topeka & Santa Fe Coast Lines at San Bernardino, Cal., has resigned.

Mr. W. O. Houston has been appointed chief engineer of the New Orleans Great Northern, with offices at Covington, La. Mr. Houston reports direct to the general superintendent.

Mr. E. W. Kolb, supervisor of signals of the Nebraska division of the Union Pacific, has been appointed engineer of electrical signals of the Chicago, Rock Island & Pacific. He will have supervision over construction, changes and inspection of electrical signal apparatus.

Mr. J. W. Guffey has resigned his position as roadmaster of the Atchison, Topeka & Santa Fe at Arkansas City, Kan., and has become roadmaster of the Chicago, Rock Island & Pacific at Haileyville, Okla.

Mr. John G. Sullivan, formerly assistant engineer on the Panama Canal, has been appointed chief engineer of the eastern division of the Canadian Pacific at Montreal. He succeeds Mr. F. P. Cutelius, promoted to general superintendent of the Lake Superior division.

Mr. William M. Duane, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Ry., has resigned to engage in other business.

Mr. C. C. Smythe has been appointed acting general foreman of the bridge and building departments of the Chicago, Cincinnati & Louisville, succeeding S. H. Shinn.

Mr. G. W. Daves, signal inspector of the Chicago & Alton, has been appointed signal engineer of the Chicago & Alton and of the Toledo, St. Louis & Western, succeeding his father, William Daves, resigned.

Mr. J. J. Evans has been appointed signal supervisor of the Chicago, Rock Island & Pacific at El Reno, Okla., with jurisdiction over the Choctaw and the Southern districts. Mr. F. J. Hemphill acting signal supervisor of the Illinois division, with office at Ottawa, Ill., will until further notice have jurisdiction over the Missouri division. Mr. Charles Hattery, signal supervisor of the Kansas division, with office at Topeka, Kan., has been given jurisdiction over the El Reno and the St. Louis divisions.

Mr. E. J. Bohanan, roadmaster of the Chicago, Rock Island & Pacific at Little Rock, Ark., has been appointed roadmaster of the Kansas City Southern at Port Arthur, Tex., succeeding J. A. Waller, resigned.

Mr. J. A. Allen has been appointed roadmaster of the Southern Pacific lines east of Sparks, Nev., with office at Ogden, Utah, succeeding Frederick Easton.

Mr. W. I. Davis, roadmaster of the Chicago, Rock Island & Pacific at Haileyville Okla., with jurisdiction over the Ardmore branch, will hereafter have jurisdiction over the line from Booneville, Ark., to Haileyville, Okla., with headquarters at the latter place.

Mr. N. E. Baker was recently appointed signal engineer of the Illinois Central and Mr. H. F. Somas succeeds him as assistant signal engineer.

Trade Notes

The Adreon Mfg. Co., St. Louis, Mo., has been organized by E. L. Adreon, Jr., D. R. Niederlander and William Miller, for the purpose of manufacturing and selling railway supplies. The home office of the company wil be located in the Security building, St. Louis, and Mr. Miller, vice-president, will have charge of the Chicago office at 300 Western Union building. The company will represent in the southwest: The American Brake Shoe & Foundry Company; The Steel Car Forge Company; The Pittsburgh Lamp, Brass & Glass Company, and the Acme Pipe Clamp Company, and will manufacture on its own account the Campbell graphite lubricator, the Security bell ringer, the Security back-up valve, the Security rail brace and tie plate, and the American gravity coupling for locomotive tenders.

Mr. John C. Sesser, formerly engineer of maintenance of way of the Missouri District of the Chicago, Burlington & Quincy, has been appointed contracting engineer for the Walsh Construction Company, Davenport, Ia., with headquarters at Chicago.

The L. M. Booth Company, 136 Liberty street, New York, maker of water softening apparatus, has engaged the services of W. R. Toppan and W. H. Green, formerly with the Kennicott Water Softener Company, Chicago Heights, Ill. Mr. Toppan becomes vice-president and general manager with offices in Chicago, and will have charge of the steam railroad department. Mr. Green will cover the Middle West, with headquarters in Chicago.

Mr. Dixon Boardman, formerly special agent of the Hall Signal Company, New York, has returned to that company, and is now in England as manager for Great Britain, with office at Queen Anne's Chambers, Westminster, London, S. W. His work is particularly in connection with the manufacture of Hall signals in Great Britain, as required by the British patent law which recently went into effect. Mr. Boardman represented the company in England two years ago.

The Western Sheet & Structural Iron Works, Salt Lake City, Utah, is being organized with a capital stock of $150,000 to build a plant and manufacture sheet and structural iron. It is said that a site has been purchased and that within forty days work will begin on the erection of the works. Mr. Charles H. Henderson, president of the Salt Lake Construction Company, Atlas block, Salt Lake City, Utah, is promoting the company. Others interested include Messrs. Frank Simmons, G. S. Barr and F. A. Fafek.

The Clark Cast Steel Cement Company, Shelton, Conn., announce that its Chicago interests have been placed in the hands of R. T. Oglesby, 34 South Clark street, Chicago. The Clark company was formerly represented by Frank L. Jones, who on account of change of residence was forced to cancel his representation in Chicago.

The Hayes Track Appliance Company, Geneva, N. Y., recently established a factory at Hamilton, Ont., to make Hayes derails for the Canadian market. The company recently made shipments of Hayes derails to Natal, South Africa, and to Alaska. Among recent installations in this country are those on the tracks of the Hudson & Manhattan to control movements at the terminals, and at the approaches to the Harlem river drawbridge on the New York Central near 138th street, New York.

The Hibner Switch & Signal Company, which was incorporated under the laws of Washington, has its office at 301 Pacific block, Seattle, Wash. An officer of the company writes that patents covering all of the devices invented by Phillip D. Hibner have been obtained for the United States, Canada and nearly all foreign countries.

The Raymond Concrete Pile Company, New York and Chicago, has recently issued a booklet on the Raymond system of concrete piling. The method of making Raymond concrete piles, the influence of the shell upon their permanence, the advantages of the tapering shape, and the rapid method of placing these piles are some of the topics discussed. Specifications and standard sizes are also given.

Technical Publications

ELEMENTS OF RAILROAD TRACK AND CONSTRUCTION, by Winter L. Wilson. Published by John Wiley & Sons, New York. Cloth binding, 313 pages, 4½x7 ins., illustrated. Price, $2.00.

The book presents fundamental principles of track and railroad construction which are intended to give the unexperienced student a general idea. It is, of course, written mainly for class-room purposes and not for engineers engaged in railroad construction.

The chapter headings are as follows: History of railroads in the United States; permanent way; turnouts; sidetracks, yards, terminals and signals; maintenance of way; railroad construction; trestles; culverts, and the subgrade.

As a preliminary study on railroad construction work it is indeed a valuable treatise and should be used extensively in the technical schools.

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